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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/300,494	04/28/1999	ARTHUR ROBERT CALDERBANK	CALDERBANK-1	4523

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EXAMINER

FAN, CHIEH M

ART UNIT	PAPER NUMBER
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2634

DATE MAILED: 04/23/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/300,494

Applicant(s)

CALDERBANK ET AL.

Examiner

Chieh M Fan

Art Unit

2634

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 16 December 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 3-8 and 11-20 is/are pending in the application.
- 4a) Of the above claim(s) 11-14 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 3,4,7,8,15,16 and 20 is/are rejected.
- 7) ☒ Claim(s) 5,6 and 17-19 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 28 April 1999 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_ 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Specification***

1. The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required: The specification only teaches a “mapper and pulse shaper” block (16 and 36 in Fig. 1 and 43 and 53 in Fig. 2). The specification never specifies the order of the mapper and the pulse shaper as claimed in claim 2 (i.e., a mapper followed by a pulse shaper).

### ***Claim Objections***

2. Claims 4-8 and 17-19 are objected to because of the following informalities:
- Regarding claims 4-8, the examiner suggests the following changes so as to be consistent with the terminology “channel coding encoders” used in line 4 of claim 4:
- “channel coder” in line 3 of claim 4 should be “channel coding encoder”;
- “channel coders” in line 2 of claim 5 and in line 2 of claim 6 should be “channel coding encoders”.
- Regarding claims 16-19,
- a. “said modulator” in line 6 of claim 16 should be “said mapper”.

b. the limitation " $i=1,2,\dots,L$ " in line 1 of claim 17 should be placed after the limitation "at rate  $R_i$ " in line 2.

c. " $R_1 < R_2 < L < R_L$ " in line 3 of claim 19 should be " $R_1 < R_2 < \dots < R_L$ ".

Appropriate correction is required.

***Claim Rejections - 35 USC § 103***

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. Claims 3 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Calderbank et al. (US Patent 6,127,971, "Calderbank" hereinafter) In view of Naguib et al. ("Space-Time Coded Modulation for High Data Rate Wireless Communications", IEEE, 03/11/1997, "Naguib" hereinafter).

Calderbank (different inventive entity) teach a transmitter comprising:

A demultiplexer (100 in Fig. 1) responsive to an input signal for developing a plurality of at least two signal streams, and

A like plurality of space-time coding transmitters (see 110, 110-1, 110-2, 120, 120-1, 102-2, 130, 130-1, and 130-2 in Fig. 1), each responsive to a different signal stream of said plurality of signal streams.

Calderbank does not teach a respective channel coder coupled in front of each of the space-time encoders 110, 120, and 130.

However, Naguib teaches that, in the same field of endeavor, a Reed Solomon block encoder coupled in front of a space-time encoder (see Fig. 5). The Reed Solomon block encoder is used as an outer code. Naguib further teaches that the reason for using an outer block code is, at reasonable values of SNR, when only the space-time code is used, most of the frame errors are due to very few symbol errors per frame, most of which can be recovered by the use of an outer block code (see lines 1-7 under section 3.2 of page 105).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to couple a respective channel coder in front of each of the space-time coders 110, 120 and 130 of Calderbank, as taught by Naguib, so as to correct frame errors.

5. Claims 4 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Calderbank et al. (US Patent 6,127,971, "Calderbank" hereinafter) In view of Naguib et al. ("Space-Time Coded Modulation for High Data Rate Wireless Communications", IEEE, 03/11/1997, "Naguib" hereinafter) as applied to claims 3 and 15 above, and further in view of Calderbank et al. (US Patent 6,088,408, "Calderbank '408" hereinafter).

Calderbank in view of Naguib teaches all the subject matter of the claimed invention including a plurality of pulse shapers (col. 3, lines 39-41 of Calderbank) and a plurality of antennas coupled to the transmitters 110-1, 110-2, 120-1, 120-2, 130-1 and 130-2 of Calderbank, but does not specifically teach the output of each of the space-

time encoders is coupled to a mapper and the output of the mapper is coupled to a pulse shaper, i.e., a mapper is coupled between the space-time shaper and the pulse shaper.

However, the use of a constellation mapper that maps an encoded data to a signal point on a constellation of a digital communication scheme (e.g. QAM, QPSK, and so on) is well known in the art. Calderbank '408 teaches a mapper (14-1 through 14-n in Fig. 1) that is coupled between a space-time encoder and a pulse shaper.

In a digital communication system, a mapper is explicitly required to map the encoded data (in digital forms) into one of the particular analog signal waveforms associated with each signal point on the constellation so as to facilitate transmission over a communication channel. The mapping also has the advantage of bandwidth efficiency if the digital communication scheme is a M-ary scheme. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to couple a mapper to the space-time encoder for the purpose of transforming the encoded data to signal waveform for transmission and for the advantage of bandwidth efficiency.

6. Claims 7, 8 and 20 rejected under 35 U.S.C. 103(a) as being unpatentable over Calderbank et al. (US Patent 6,127,971, "Calderbank" hereinafter) In view of Naguib et al. ("Space-Time Coded Modulation for High Data Rate Wireless Communications", IEEE, 03/11/1997, "Naguib" hereinafter) and Calderbank et al. (US Patent 6,088,408,

"Calderbank '408" hereinafter) as applied to claims 4 and 16 above, and further in view of Gray (US Patent 5,931,968).

Calderbank in view of Naguib and Calderbank '408 teach the claimed invention except that the channel coder performs trellis encoding or convolutional encoding (Calderbank in view of Naguib specifies that the channel coder performs Reed Solomon encoding). However, the use of Reed Solomon encoding, trellis encoding or convolutional encoding as a channel encoding scheme is well known in the art. Gray teaches the use of a trellis encoding or a convolutional encoding in place of a Reed Solomon encoding to be an error-encoding scheme (col. 4, lines 20-25). Further, the advantage of trellis or convolutional encoding, such as enhancing noise immunity, is also well known in the art. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use trellis encoding or convolutional encoding as the channel-coding scheme for the advantage of enhancing noise immunity.

### ***Response to Arguments***

7. Applicant's arguments filed 12/16/02 have been fully considered but they are not persuasive.

a. The argument made by the applicants on page 4 of the amendment regarding the rejection under 35 USC 103 of claims 3, 4, 15 and 16 does not seem to be completed. It appears to the examiner that there should be something more after the

last word "with". Based the examiner's best effort to understand the argument, the applicants appear to argue that the Naguib et al article only teaches a single block encoder that precedes a single space-time encoder. Therefore, combining the teaching of Naguib and the '971 patent will not teach the claimed invention.

Examiner's response --- In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). The '971 patent teaches a demultiplexer that divides the input signal and sends the divided signal to a plurality of signal paths. Each signal path has an individual space-time encoder. On the other hand, the Naguib article teaches that a channel encoder (a Reed Solomon block encoder) coupled in front of a space-time encoder (see Fig. 5). The Reed Solomon block encoder is used as an outer code. Naguib further teaches that the reason for using an outer block code is, at reasonable values of SNR, when only the space-time code is used, most of the frame errors are due to very few symbol errors per frame, most of which can be recovered by the use of an outer block code (see lines 1-7 under section 3.2 of page 105). Therefore, based on the teaching of the '971 patent and Naguib, it would have been obvious to one of ordinary skill in the art at the time the invention was made to place a channel encoder prior to the space-time encoder in each of the signal paths so as to recover the frame error along each of the signal paths. A person of ordinary skill in the art would be motivated to place a channel encoder in each of the signal paths because each of the



signal paths may generate frame errors. The applicants' argument that the combined teaching only teaches a channel encoder that precedes a space-time encoder is not persuasive.

b. The applicants further argues that, regarding the claim objection of claim 17, the location of  $i=1,2,\dots,L$  is proper because index  $i$  specifies the channel coding encoder.

Examiner's response --- If the applicants intend to use an index to specify the channel coding encoder, a proper way is to write the limitation as "...each channel coding encoder  $C_i$ ,  $i=1,2,\dots,L$  in said  $L$  plurality ....". In claim 17, the symbol " $i$ " has been used as an index. The symbol " $i$ " cannot be also used as a variable to represent the channel coding encoder.

### ***Allowable Subject Matter***

8. Claims 5, 6, 17 and 18 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

***Conclusion***

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chieh M Fan whose telephone number is (703) 305-0198. The examiner can normally be reached on Monday-Friday 8:00AM-5:30PM, Alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Chin can be reached on (703) 305-4714. The fax phone numbers

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for the organization where this application or proceeding is assigned are (703) 872-9314 for regular communications and (703) 872-9314 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-4750.

Chieh M Fan   
Examiner  
Art Unit 2634

cmf  
April 14, 2003

  
**STEPHEN CHIN**  
**SUPERVISORY PATENT EXAMINER**  
**TECHNOLOGY CENTER 2600**